

# AN ESSAY ON ORIGAMIC AND ISOMORPHIC APPROACH AS INTERFACE OF FORM IN ARCHITECTURAL BASIC DESIGN EDUCATION

Mimarlık Temel Tasarım Eğitiminde Formun Arayüzü Olarak Origamik Ve İzomorfik Yaklaşım Üzerine Bir Deneme

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## ABSTRACT

It is a fact that today's technology shapes the change and development of architectural forms by creating different perspectives. The research is an experimental study that explores the integration of architectural forms in this process of change/development into design education through traditional design tools. An examination of the practices in the studio environment shows that the students who just started architectural education have difficulty accessing the form. The main objective of this study has been to enable students to use and interpret different disciplines in the design process in order to improve their perception of form. In this sense, the origami, which is defined as "the art of paper folding", and isomorphous (equally formed) approaches have been used with design studio students at the beginning stage as methods in the process of 3-dimensional thinking and creating the form. These two methods were examined with students in three stages: analysis, creation, and outcome. As a result of the study, it was seen that the use of different disciplines as a method during form creation gave the designs of the student originality, freedom, and dynamism.

**Key Words:** Architectural Form, Design Education, Isomorphic Approach, Origamic Approach.

## ÖZET

Günümüz teknolojisinin farklı bakış açıları yaratarak mimari formların değişim ve gelişimine yön verdiği bir gerçektir. Çalışma bu değişim/gelişim sürecindeki mimari formların geleneksel tasarım araçları ile tasarım eğitimine entegrasyonunu araştıran deneysel bir eğitim çalışması niteliği taşımaktadır. Stüdyo ortamında yapılan uygulamalara bakıldığında mimarlık eğitimine yeni başlayan öğrencilerin forma ulaşırken zorlandıkları görülmektedir. Öğrencilerin form algısını geliştirerek farkındalıklarını arttırabilmek için tasarım süreci içinde farklı disiplinleri kullanabilmesi ve yorumlayabilmesi bu çalışmanın ana hedefi olmuştur. Bu anlamda başlangıç aşamasındaki tasarım stüdyosu öğrencileri ile "kağıt katlama sanatı" olarak tanımlanan origami ve "eş biçimli" anlamına gelen izomorfik yaklaşımlarının 3 boyutlu düşünme ve formu oluşturma sürecinde bir yöntem olarak kullanılması denenmiştir. Bu iki yöntem öğrenciler ile analiz, yaratım ve sonuç olmak üzere üç aşamada irdelenmiştir. Çalışma sonucunda, form oluşturma esnasında farklı disiplinlerin yöntem olarak kullanımı, öğrencilerin tasarımlarına özgünlük, özgürlük ve dinamizm kazandırdığı görülmüştür.

**Anahtar Kelimeler:** Mimari Form, Tasarım Eğitimi, İzomorfik Yaklaşım, Origamik Yaklaşım.

## 1. INTRODUCTION

Form is a multi-faceted concept that carries functional, spatial, spiritual, symbolic, semantic, etc. predicates that determine the relations of architectural product with its physical and social environment (Onat, 2010). Therefore, it is one of the problem areas where the architect is most sensitive about.

Yakan (1999) defined the architectural form as the processing and transformation of all the forms we perceive (regular-irregular) in order to create architectural works. According to him, the form is realized when it corresponds to a function and when it integrates with a social and physical environment, and makes sense with the success of the designer in using the form.

In this sense, the form of the building is important in terms of architectural value as it is the first perceived and striking element of architecture when evaluated in the context of the human-environment relationship. In this sense, it is seen that the discourses and debates on the concept of form have always continued to be relevant throughout the history of architecture. In this context, Sullivan's (1896) "Form ever follows function", Niemeyer's "My work is not about 'form follows function', but 'form follows beauty' or, even better, 'form follows feminine" (Metz, 1997) and Lim's "Form Follows movement" (2019) are remarkable interpretations of the change in the form approach.

While the ancient Greek, Roman and Egyptian civilizations used simple geometric forms such as cylinders, cubes, and pyramids, the material developed with the first industrial revolution allowed different pursuits and ideas in the forms as well. Digital technology, which came to the forefront with the information revolution or second industrial revolution, as J. Mitchell put it, took the design environment into an unlimited space called cyberspace, while the architectural form began to question foundations of Cartesian.

Kolerevich (2003) expresses this change in the design environment with the words

*"Digital technologies have been influencing and changing architectural practices in various ways recently. Non-Euclidean geometry, kinetic and dynamic systems, genetic algorithms are replacing technological architecture. Dynamic, defined as the open-ended three-dimensional structure of the consistent transformation has given impetus to new architectural possibilities".*

## 2. SCOPE OF THE STUDY

Research and observations show that the student has the most difficulty in creating forms during the architectural design process (Çolak, 2015). For this purpose, it is thought that the design process will be more efficient when the student's effort to find a form in architecture education is supported by a certain method. In this context, the main material of this article is the studies carried out with the students of Çukurova University Department of Architecture during the 14-week study period within the scope of Basic Design Course II during the 2017-2018 Spring Semester.

Therefore, in this study, it was aimed to use "origamic" and "isomorphic" approaches as interfaces for the search of forms by the 1st year students of architecture within the scope of the Basic Design Course.

## 3. DESIGN TOOLS USED

During this study, traditional methods (models and sketches) and digital methods (3d) were used together in the same design studio.

Sketch: Howard (1993) argues that sketches made on any paper with a soft pencil are to feel the spirit of design, such as the scent of wood, the coldness of steel (Ketizmen, 2002). Therefore, sketches as a traditional tool of the basic design course have been chosen as a tool that has been used since the early stages of the design process. These lines, which can also be called as lines of search, were used by the student in order to reach specific certainties of the design.

Models: As a tool in the design phase, models are able to instantly show the scale, form and material characteristics of an architectural idea. In this respect, the use of models is one of the most important techniques used in the development of three-dimensional thinking. Therefore, the use of digital modeling systems together with the "model", which is one of *the traditional method tools* of the students, has been continuously supported throughout the design process.

#### 4. METHOD OF THE STUDY

Origamic and Isomorphic Approaches were presented to the students' preferences in order to question the different formal searches during the Basic Design Course application process.

##### 4.1. Origamic Approach (Geometry of Folds)

Origami often described as "*the art of paper folding*", is an interdisciplinary methodology (from mathematics to architecture, biology to engineering, and various applications) with its mathematical and geometric pattern relations today (Göneç Sorguç, Hagiwara ve Arslan Selçuk, 2009). In this sense, the Automobile museum constructed in China and the building forms of the chapel in the village of St-Loup in Switzerland are examples of practices in the architectural discipline of origami art (Fig. 1).

Automobile Museum,  
Nanjing-China, 2010



St Loup Chapel, Switzerland, 2007



**Figure 1.** Examples of Origamic Approach (Url 1; Url 2)

##### 4.2. Isomorphic Approach (Geometry of Connections)

Isomorphic, meaning "equal-shaped", refers to another point of departure from Euclidean geometry and Cartesian space. Isomorphic surfaces can be obtained by bending and twisting the parametric objects mutually with their mass, internal force, and gravity. In other words, isomorphic surfaces/forms are obtained by joining, removing and homogeneously rounding the joints of at least two objects of different sizes (Altunbaş, 2009). In this context, the BMW Exhibition Pavilion presented in Germany along with the forms of Zaha Hadid's masterplan proposal for Istanbul both constitute examples of the isomorphic approach in the architectural discipline.

BMW Pavilion, 1999 (Bernhard Franken, Frankfurt-  
Almanya)



Kartal-Pendik Masterplan, 2007 (Zaha Hadid, Istanbul-  
Turkey)



**Figure 2.** Examples of Isomorphic Approach (Url 3; Url 4)

Thus, both origami and isomorphic approach, which constitute the main structuring of this study, are given to the students as an interface for developing structure and space designs. In this context, students were expected to

- Create dynamic forms in the transfer of the Origami approach to the design process, starting with a surface and resulting in volume/space only through folds without using glue, and
- Reach fluid and amorphous forms as a result of the combination of at least two elements through a mathematical flexion with the use of the isomorphic approach.

## 5. FORM-FINDING DESIGN PROCESS IN THE STUDY

As part of the basic design course, the first year students of the Department of Architecture were given a semi-open space design as a meeting point, where they could perform various social activities together, as a design problem. Thus, it was aimed that the students will be able to associate the formation of form with the use of origami and isomorphic methods in the design process.

For this purpose, the 14-week design process (4 hours a week) was designed in three stages: analysis, creation, and result (Table 1).



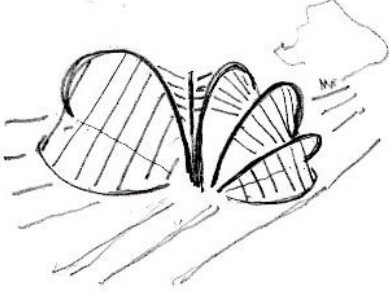

**Table 1.** Form-Finding Design Process in the Study

	Literature, Sketching
<b>ANALYSIS</b>	-Collection of the data related to the given subject and area, -Access to descriptions/readings and sample applications related to isomorphic and origamic approaches, -Production of the initial sketches,
	Digital and Physical Model
<b>CREATION</b>	-Formation of design by interpretation in line with the abstract data obtained, -Formal queries through digital and physical models,
	Traditional Design Tools
<b>RESULT</b>	-Presentation of the final product in the form of a model and report,

## 6. STUDENT STUDIES

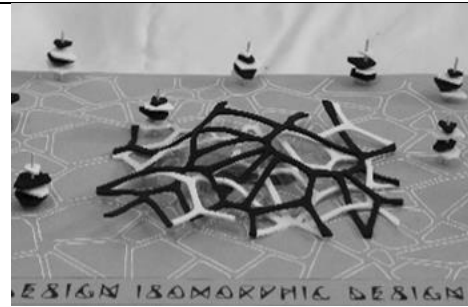
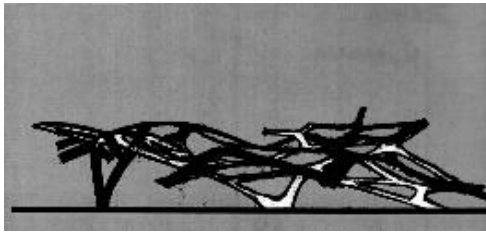
At the end of the data analysis process, the isomorphic approach of 9 students and origamic approach of 6 students out of a total of 16 students were selected. However, in the process, a total of 10 students (5 students - isomorphic approach and 5 students - origami approach) completed the study process without any interruption. In this context, students' studies were taken as final submission together with their reports (Tables 2, 3).

**Table 2.** Isomorphic Forms Student Design Studio Works

	SKETCH	PHYSICAL MODEL
Recai Çoban		
	This work is in a forest area. Amorphous lines, which do not have vertical bearing elements, but are wrapped in trees creating isomorphic transitions, have created semi-open spaces.	
Fatma Baştuğ		
	It is a work designed on the gathering area of the students and using the spaces as a semi-open space by establishing a relationship with each other at certain angles.	

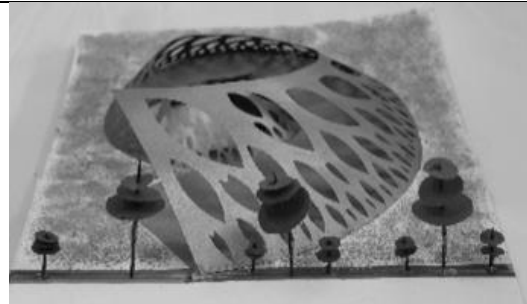
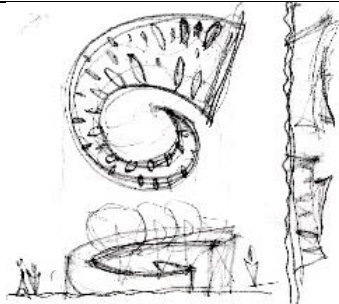


Zehra Karahan



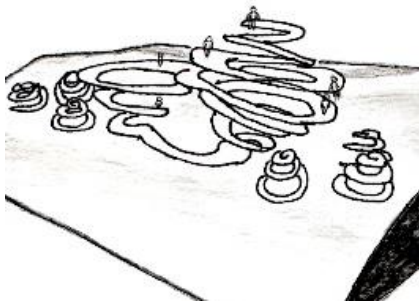
The students have been aimed to establish an emotional connection with the gathering area, and in this direction, a design that activates the sense of touch has been developed through organic and ergonomic blobjects.

Feyzanur Gürz



An unusual and surprising semi-open lecture theater with a spiral approach has been considered. The structural roof of the lecture theater, in line with the logic of the isomorphic approach, was thought to be light games and discharges.

Dürdane Ardağlı



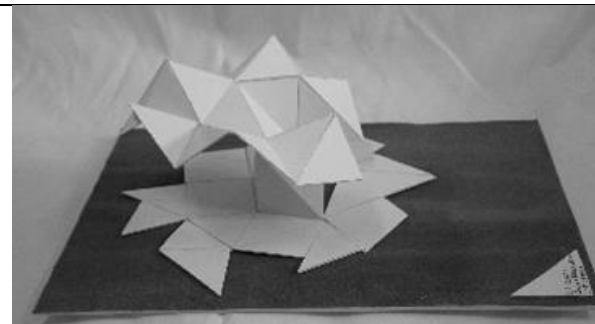
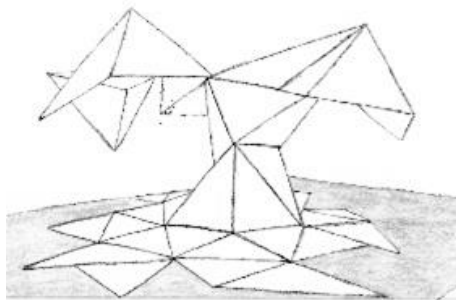
You can relax in the design area consisting of spirals moving up and down and walk along the landscape.

**Table 3.** Organic Forms Student Design Studio Works

SKETCH

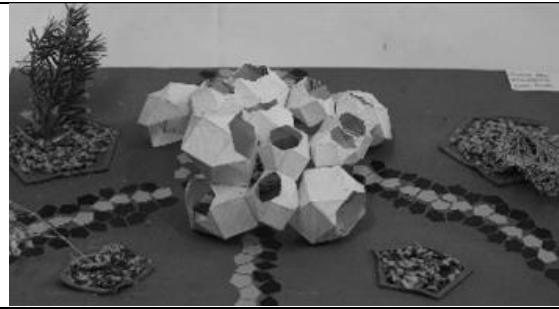
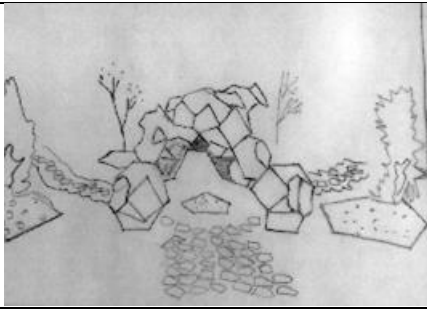
PHYSICAL MODEL

Zeynep Kocaman



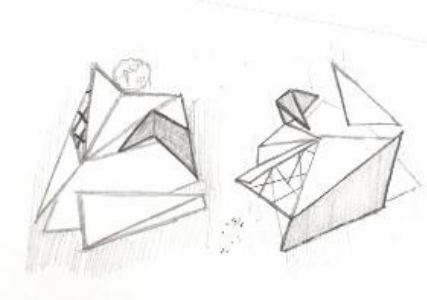
A unique pavilion design that stands out among ordinary buildings has been aimed, and an integrated pavilion has been obtained by transforming the surfaces from floor to wall, and from wall to eaves with an origamic approach.

Melisa Altun



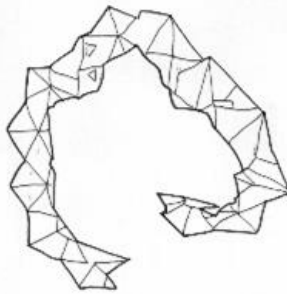
It has been designed as a resting area on a busy circulation line. Facing different directions, these spaces offer different views to the resting student each time.

Merve Küçükcan



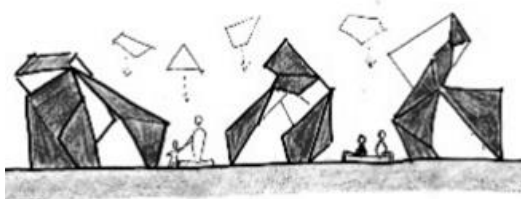
A semi-open space has been designed for rest-gathering, which is structurally free and dominated by the free rhythm. In this respect, exponential spatialization of topography has been experienced with the origamic approach.

Şükran Baş



It has been planned that the shell obtained by this origamic approach will establish a dynamic relationship with the students. In this sense, each form surface with different directions and sizes has been transformed into a digital panel. Thus, with these panels that are considered to be continuously active, the student entering the space is allowed to move away from the current life a little.

Yiğit Özelpinarlı



The aim of the design is to create sheltered defined spaces where students can spend time comfortably. While using the black-and-white contrast as color, seating elements have been arranged in the open space to provide the shape-ground relationship.

## 7. CONCLUSION

The solution of a problem is often hidden in an interdisciplinary relationship. In this sense, it has been tried to be structured for architecture students how they can benefit from different disciplines as a method during the course of Basic Design course education with isomorphic and origamic approaches.

As a result of the study using isomorphic and origamic approaches conducted with the students within the

scope of Basic Design II course, it has been tried to be exemplified with the applications and discussions that

- Students can create new forms by articulating and twisting surfaces and/or volumes,
- Students can develop their quest for the original form without being bound to a certain format.
- Students can direct their quest for aesthetics through proportional relations instead of random forms,
- Students can bring dynamism to the form by combining familiar geometric surfaces or shapes and repeating them,
- Students can develop the ability to interpret the data reached during the design process,
- Students can use their imagination more easily.

The learning outcome of this work for the student is the fact that the method proposed is positive in terms of enriching the design process in order to develop different perspectives within architecture education.

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